REMARKS

Claims 1-13, 15-25, 36-39, 41-46, and 64-70 are pending. Claims 1-13 and 15-25 are withdrawn as to a non-elected species. Applicant respectfully requests reconsideration of the above-referenced application in light of the following remarks.

Claim 36-39, 41-46 and 64-70 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,140,168 ("Tan") in view of U.S. Patent No. 5,814,563 ("Ding"). The rejection is respectfully traversed.

At the outset, Applicant respectfully submits that the Office Action fails to set forth a *prima facie* case of obviousness. "To establish *prima facie* obviousness of a claimed invention, *all* the claim limitations must be taught or suggested by the prior art." M.P.E.P. § 2143.03 (emphasis added). In addition, "there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings." M.P.E.P. § 2143. Neither of these requirements is met here.

The claimed invention relates to a method of forming a contact opening in a semiconductor device which utilizes a plasma etchant mixture consisting essentially of ammonia and at least one fluorocarbon. The particular combination of ammonia and at least one fluorocarbon with specific flow rates substantially reduces or eliminates the formation of an etch stop. In addition, the claimed combination forms a protective layer that prevents erosion of the sidewall spacer when a contact opening is formed.

Claim 36 recites a process for forming an opening in an insulative layer comprising, *inter alia*, "forming a pair of adjacent gate stacks over said substrate; forming sidewall spacers on sidewalls of said adjacent gate stacks; forming an insulative layer over said substrate; forming a patterned photoresist mask layer over

said insulative layer; and, etching an opening in said insulative layer . . . using a combination consisting essentially of ammonia and at least one fluorocarbon . . . wherein the step of etching an opening in said insulative layer *forms a protective layer on said sidewall spacers that is from about 5 to about 50 Å thick.*" (emphasis added).

Claim 64 recites a method of forming a conductive plug inside a self-aligned contact opening comprising, *inter alia*, "contacting [an] insulative layer with a plasma etchant mixture consisting essentially of ammonia and at least one fluorocarbon . . . wherein said *contacting further forms a protective layer over opposed sidewall spacers . . . that is from about 5 to about 50 Å thick* . . . and depositing a conductive plug inside said etched opening such that *said conductive plug is separated from said sidewall spacers by said protective layer.*" (emphasis added).

Tan and Ding, whether considered alone or in combination, do not teach or suggest each of the claim limitations found in independent claims 36 and 64. In this case, the cited references fail to disclose or suggest, *inter alia*, "that the step of etching an opening in [an] insulative layer forms a *protective layer on [the] sidewall spacers that is from about 5 to about 50 Å thick,*" as recited in claim 36 (emphasis added), or that contacting an insulative layer with a plasma etchant mixture "forms a *protective layer over opposed sidewall spacers . . . that is from about 5 to about 50 Å thick,*" as recited in claim 64 (emphasis added).

Tan discloses forming a self-aligned contact opening in an undoped dielectric layer (FIG. 1B). An opening 118 is formed using photoresist 116 (FIG. 1B). Ions are then implanted into opening 118 and between sidewall spacers 108 (FIG. 1C). The doped portion of the dielectric layer is then removed with a mixture of etching reactive etching gases that "consist of methyl trifluoride (CHF_3), carbon tetrafluoride (CF_4), and

argon (Ar)." (Col. 3, ll. 45-47). Tan does not disclose that a protective layer is formed on the sidewall spacers that is from about 5 to about 50 Å thick.

Tan does not teach or suggest a protective layer that is from about 5 to about 50 Å thick, much less one that is formed on a sidewall spacer. The Office Action acknowledges that Tan does not teach or suggest this element, but maintains that the teachings of Tan can be modified with the teachings of Ding to arrive at the claimed invention. Office Action, at 3. Applicant respectfully disagrees.

Most notably, Ding does not teach or suggest forming a protective layer "over opposed sidewall spacers," as in the claimed invention, but rather, teaches forming a passivating deposit 46 on the side of the dielectric layer 20 that is being etched. Nor does Ding teach or suggest a protective layer "that is from about 5 to about 50 Å thick." Thus the cited references, whether considered alone or in combination, do not teach or suggest "*all* the claim limitations" as required in order to establish a *prima facie* case of obviousness.

Moreover, even if each of the claim limitations recited by claims 36 and 64 were found in these references, which they are not, the combination still does not render obvious the claimed invention. Specifically, one of ordinary skill in the art would not have been motivated to modify the teachings of Tan with those of Ding as suggested by the Office Action.

Tan relates to a process in which a self-aligned contact window is formed. To this end, Tan discloses substituting BPSG, used in the prior art, for an undoped silicon oxide layer serving as a dielectric layer (Col. 2, ll. 47-49). The exposed undoped silicon oxide that is to be etched, is subsequently doped. This establishes a predetermined, doped region 120 that is etched (FIG. 1d). Tan discloses merely uses a *conventional*

etchant composition consisting of CHF_3, CF_4, and Ar (Col. 3, ll. 45-47). Tan takes advantage of the etching selectivities of the various layers. For instance, Tan discloses that "the etching process for the self-aligned contact window 124 can be smoothly performed due to the *etching selectivities of the dielectric layer 114a, the cap layer 106, and the spacer 108*." (Col. 3, ll. 52-55) (emphasis added). Thus, Tan teaches utilizing an appropriate etching rate that will not etch the sidewall spacer so that the spacer acts as a protection for the gatestack during the etching of a pre-determined doped region.

Ding, in contrast, relates to a process gas that provides high etch rates and highly selective etching of only 'dielectric layer' 120. Ding employs a three-etchant composition. The fluorohydro-carbon gas is used for "forming passivating deposits 46 *on the* substrate 25." (Col. 5, ll. 49-51). The NH_3-generating gas is used for enhancing the etching rates by adsorping onto the surface of the substrate (Col. 5, ll. 51-53). Ding provides no objective motivation to utilize the disclosed gas combination for etching an area defined by gatestack spacers, as in the claimed invention, or to create a self-aligned contact window as taught in Tan.

One skilled in the art would not be motivated to combine Tan and Ding with such different methods. Although both references may arguably purport to etch an opening in a semiconductor device; this is where the similarity ends. Tan uses layers of the semiconductor device *itself* to control the different etch rates. Tan does not use the composition to control etch rates. Ding, in contrast, uses only the composition itself to control the etch rates. These are different processes directed to achieving different goals. A faster etch rate in Tan is *not* desired since the slower etching rate of the nitride layer results in the plasma etch stopping at the sidewall spacers 108.

Moreover, even if the references are combinable, which they are not, it is not proper to combine references where doing so "would require a substantial reconstruction and redesign of the elements shown in the primary reference [i.e., Tan] as well as a change in the basic principle under which the primary reference [i.e., Tan] construction was designed to operate." *In re Ratti*, 270 F.2d 810, 813, 123 U.S.P.Q. 349, 352 (C.C.P.A. 1959).

The 'modification' proposed by the Examiner, in the rejection of claims 36-39, 41-46 and 64-70, requires a substantial reconstruction and redesign of Tan's elements, and changes the basic principle under which Tan was designed to operate. For example, Tan relates to forming a *self-aligned contact window.* To this end, Tan uses the *etching selectivities* of dielectric layer 114a, cap layer 106, and sidewall spacers 108 to control how the self-aligned contact opening is formed.

If Ding's teachings are combined with Tan, Tan's structure would have a polymeric coating 46 formed on sidewall spacers 108. Tan would *not* be able to form a self-aligned contact opening with the presence of a polymeric coating 46. The etching sensitivity of sidewall spacers 108 would not be available, defeating the very purpose of Tan's process. The only motivation to combine these references is gleaned from Applicant's disclosure. It is improper hindsight reconstruction.

Claims 37-39 and 41-46 depend from claim 36. Claims 65-70 depend from claim 64. Claims 37-39, 41-46, and 65-70 are allowable along with their base claims for at least the reasons provided above, and on their own merits.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to review and pass this application to issue.

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Respectfully submitted,

By_____

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